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(54) **RECOVERY OF TIME DUE TO AN UNPLANNED EVENT ON A RESERVED ROUTE**

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G06Q 10/02 (2012.01)

(52) **U.S. Cl.**
CPC ***G06Q 50/30*** (2013.01); ***G06Q 10/02*** (2013.01)

(58) **Field of Classification Search**
CPC G06Q 50/30; G06Q 10/02
USPC 701/117
See application file for complete search history.

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(57) **ABSTRACT**

Providing reserved routes for a plurality of vehicles, in which the at least a location is monitored and communicated from each of a plurality of vehicles having GPS devices and traveling to destinations on reserved routes with guaranteed arrival times. For a traffic event along one of the reserved routes; determining if any of the plurality of vehicles are affected or will be affected by the traffic event and calculating alternate routes for those vehicles The alternate routes are sent to the GPS devices in the affected or possibly affected vehicles and once the vehicle has reached the destination, comparing an actual arrival time of the vehicle at the destination to the guaranteed arrival time, and if the actual arrival time is later than the guaranteed arrival time, crediting a user of the vehicle for at least a portion of an amount paid for reserving the reserved route.

20 Claims, 6 Drawing Sheets

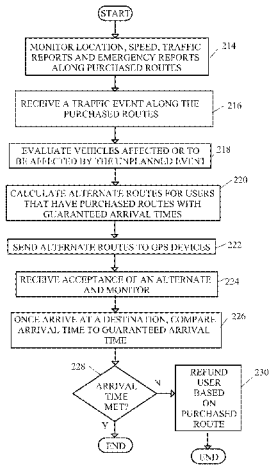

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Fig. 1

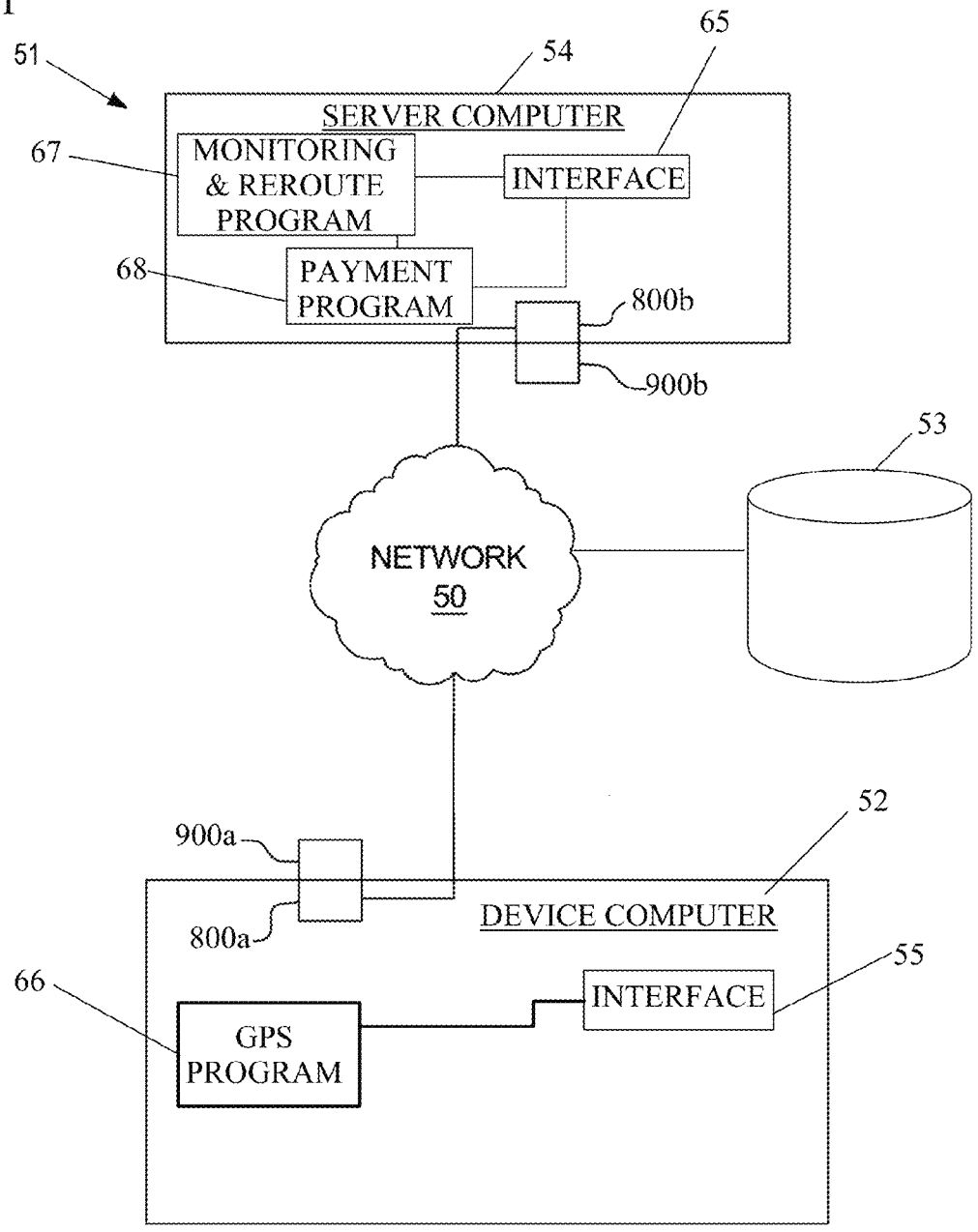

51
54
65
SERVER COMPUTER
67
MONITORING & REROUTE PROGRAM
INTERFACE
68
PAYMENT PROGRAM
800b
900b
53
NETWORK 50
900a
52
800a
DEVICE COMPUTER
66
55
INTERFACE
GPS PROGRAM

Fig. 2

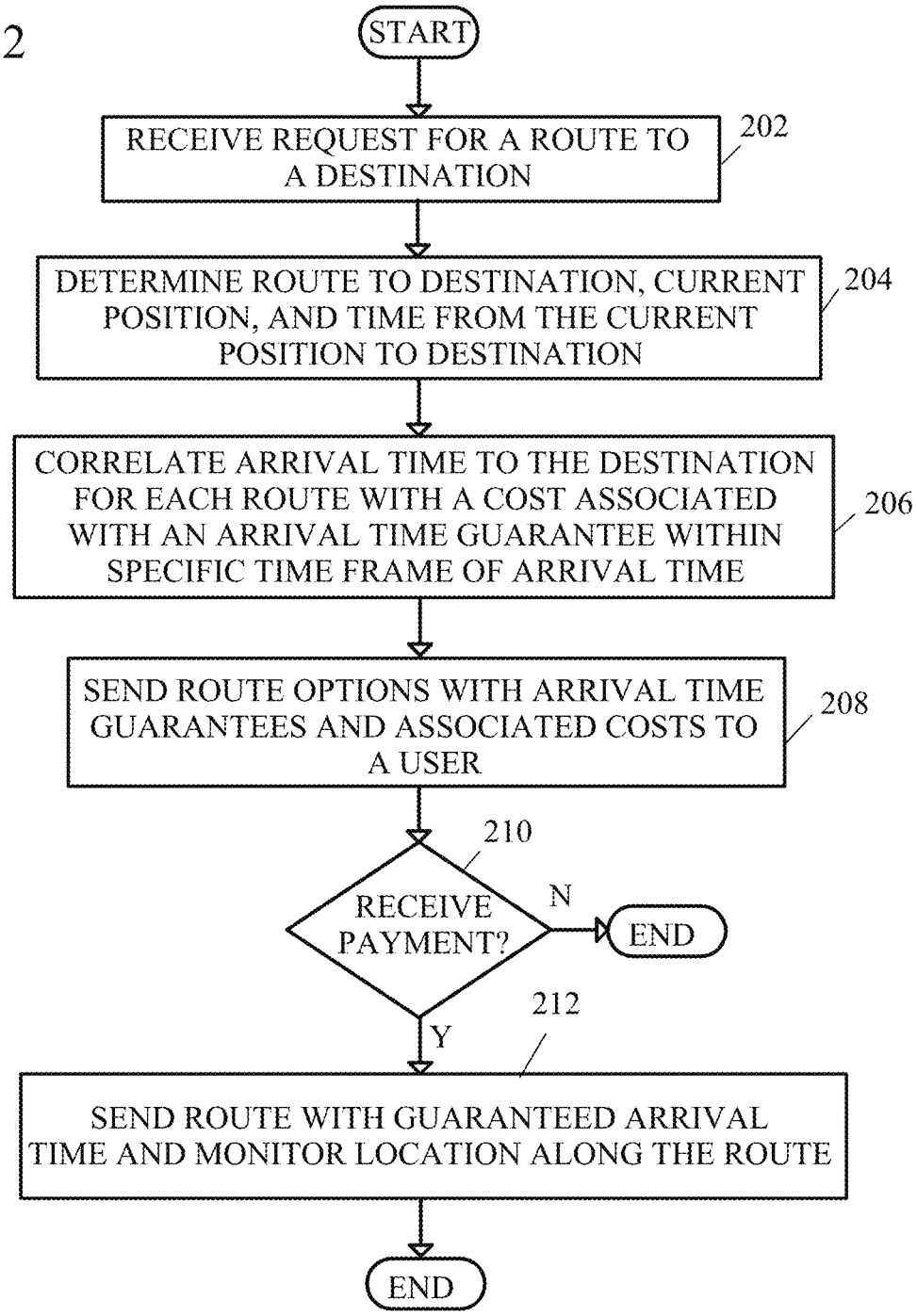

START
RECEIVE REQUEST FOR A ROUTE TO A DESTINATION
202
DETERMINE ROUTE TO DESTINATION, CURRENT POSITION, AND TIME FROM THE CURRENT POSITION TO DESTINATION
204
CORRELATE ARRIVAL TIME TO THE DESTINATION FOR EACH ROUTE WITH A COST ASSOCIATED WITH AN ARRIVAL TIME GUARANTEE WITHIN SPECIFIC TIME FRAME OF ARRIVAL TIME
206
SEND ROUTE OPTIONS WITH ARRIVAL TIME GUARANTEES AND ASSOCIATED COSTS TO A USER
208
210
RECEIVE PAYMENT?
N
END
Y
212
SEND ROUTE WITH GUARANTEED ARRIVAL TIME AND MONITOR LOCATION ALONG THE ROUTE
END

Fig. 3

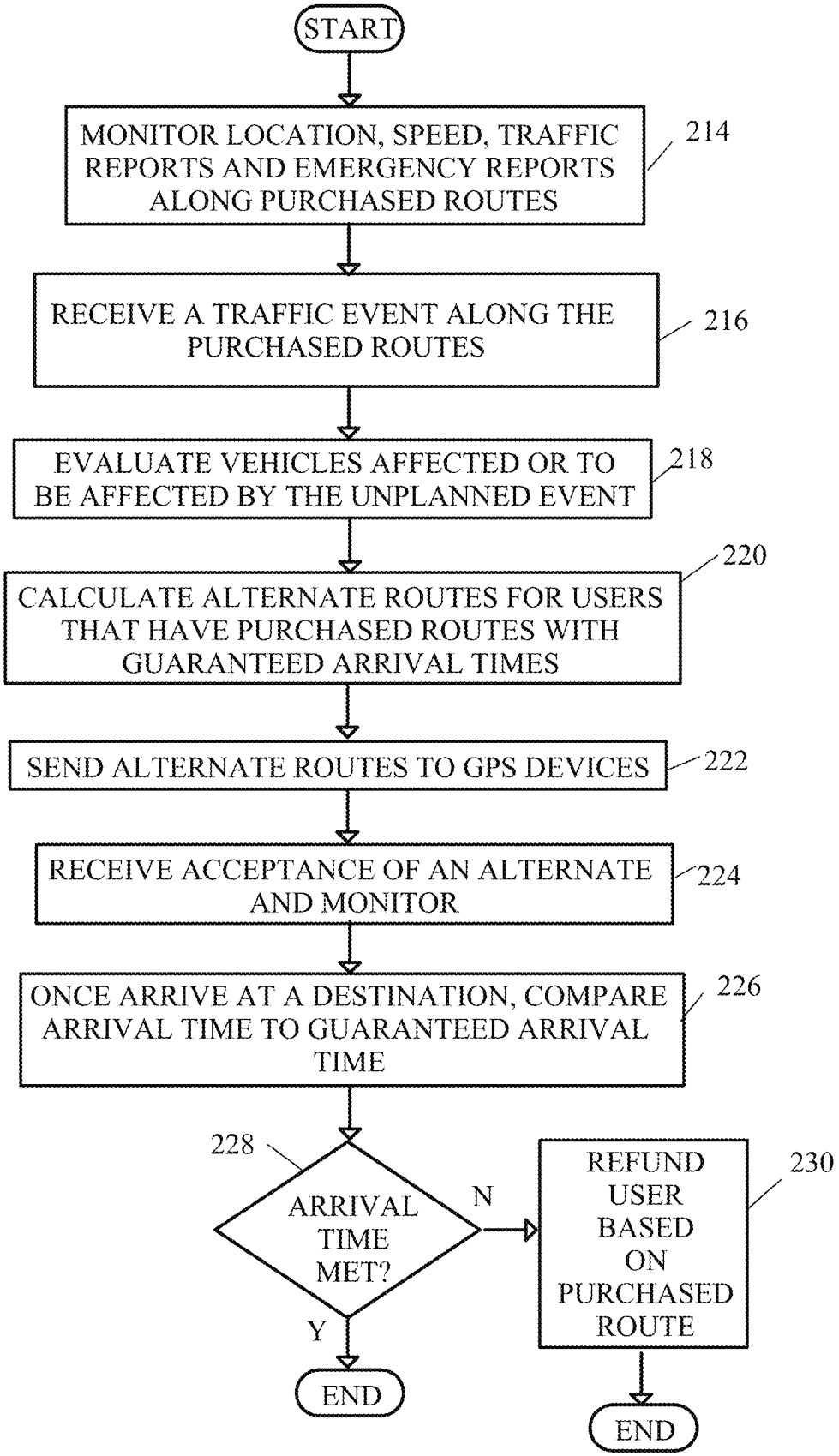
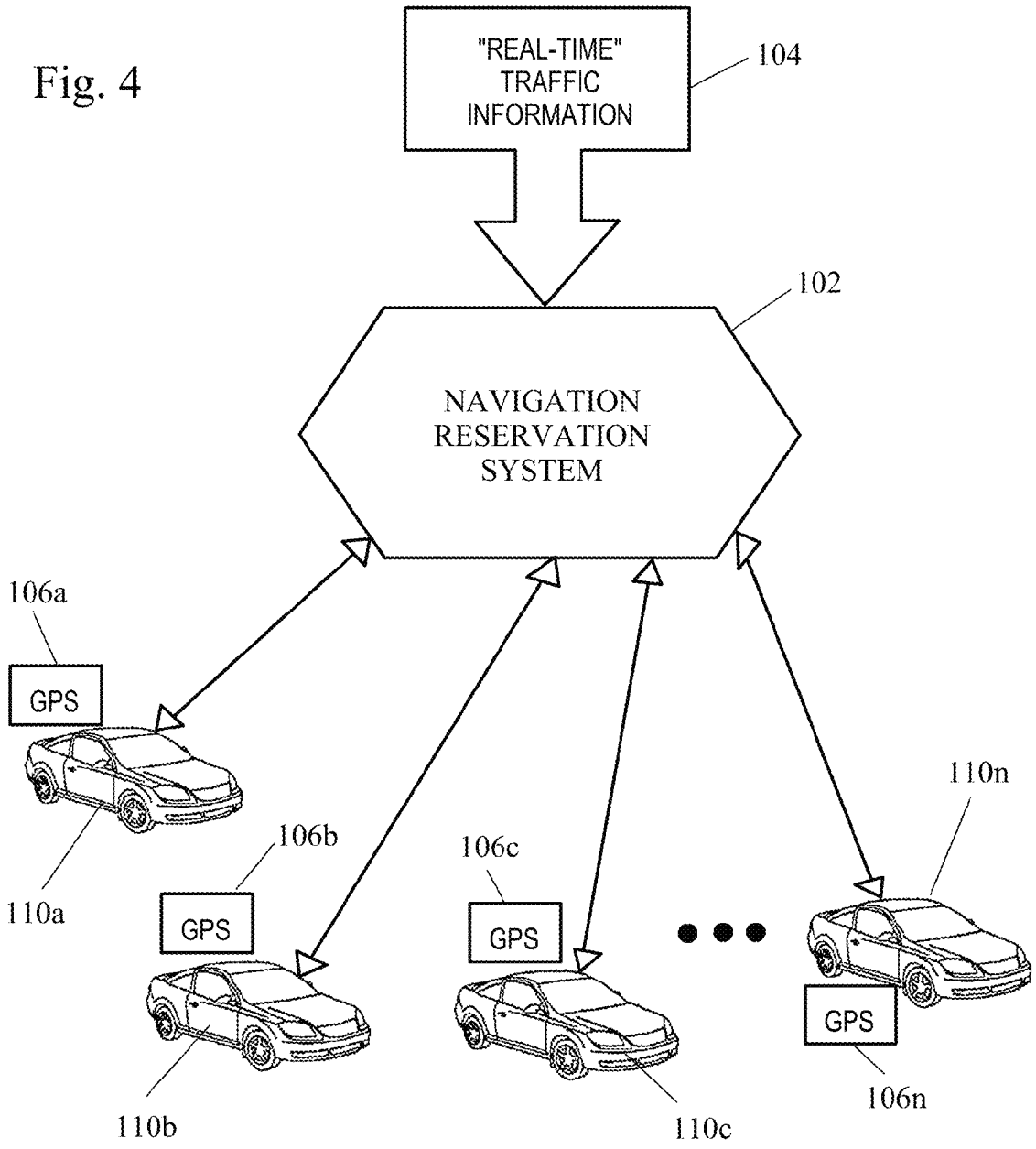

START
MONITOR LOCATION, SPEED, TRAFFIC REPORTS AND EMERGENCY REPORTS ALONG PURCHASED ROUTES
214
RECEIVE A TRAFFIC EVENT ALONG THE PURCHASED ROUTES
216
EVALUATE VEHICLES AFFECTED OR TO BE AFFECTED BY THE UNPLANNED EVENT
218
CALCULATE ALTERNATE ROUTES FOR USERS THAT HAVE PURCHASED ROUTES WITH GUARANTEED ARRIVAL TIMES
220
SEND ALTERNATE ROUTES TO GPS DEVICES
222
RECEIVE ACCEPTANCE OF AN ALTERNATE AND MONITOR
224
ONCE ARRIVE AT A DESTINATION, COMPARE ARRIVAL TIME TO GUARANTEED ARRIVAL TIME
226
228
ARRIVAL TIME MET?
N
Y
REFUND USER BASED ON PURCHASED ROUTE
230
END
END

Fig. 4


"REAL-TIME" TRAFFIC INFORMATION
104
102
NAVIGATION RESERVATION SYSTEM
106a
GPS
110a
106b
GPS
110b
106c
GPS
110c
110n
GPS
106n

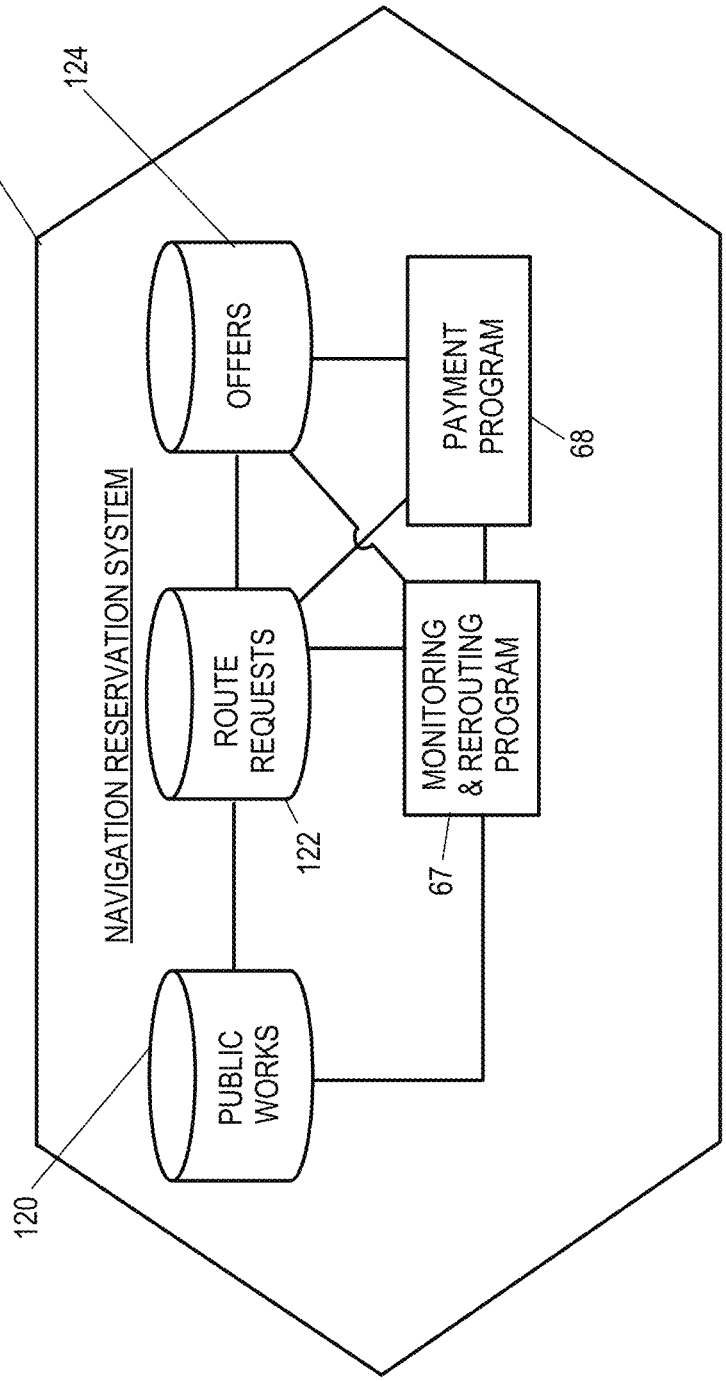

102
124
OFFERS
PAYMENT PROGRAM
68
NAVIGATION RESERVATION SYSTEM
ROUTE REQUESTS
122
MONITORING & REROUTING PROGRAM
67
PUBLIC WORKS
120

Fig. 5

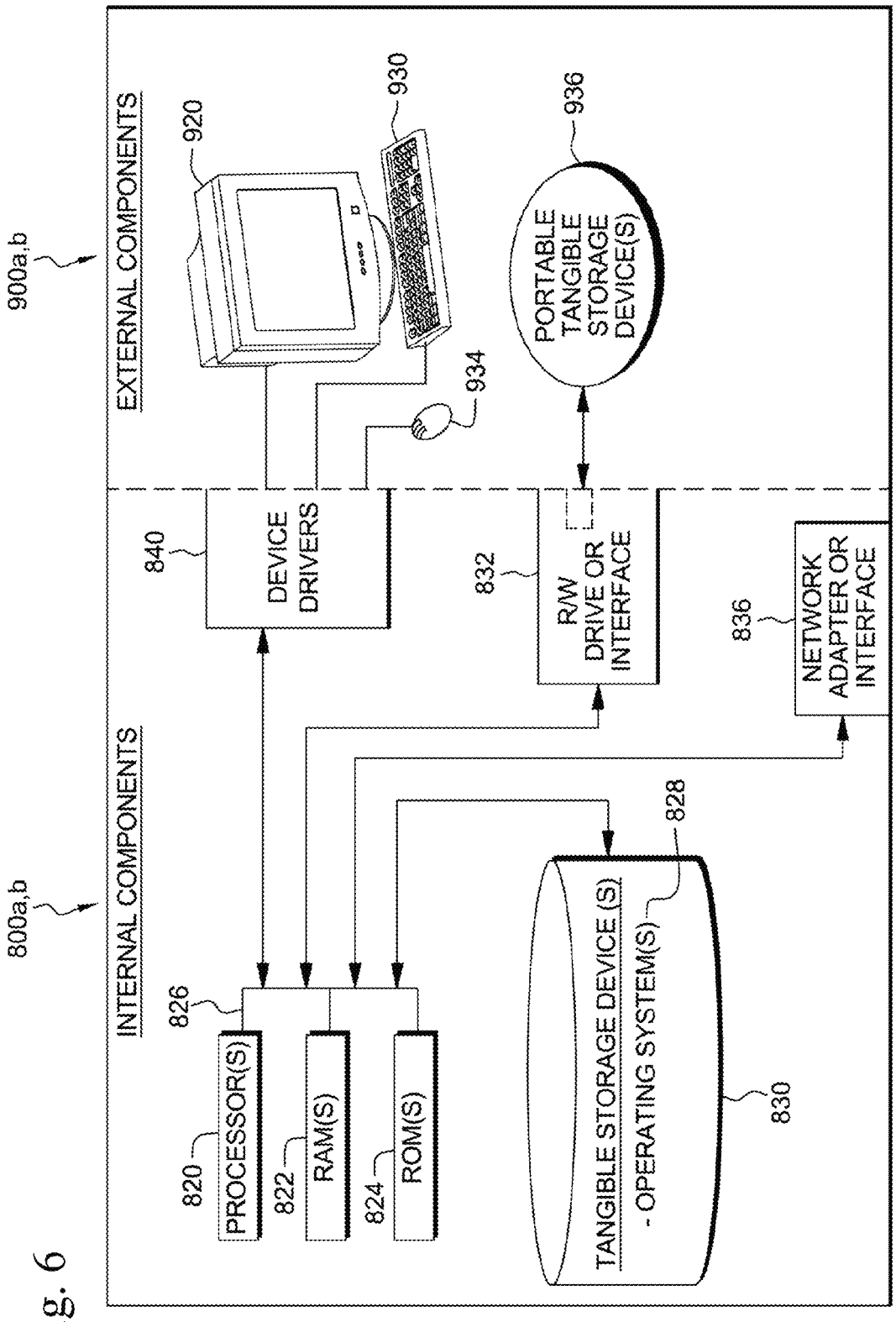

900a,b
EXTERNAL COMPONENTS
920
930
936
PORTABLE TANGIBLE STORAGE DEVICE(S)
934
840
DEVICE DRIVERS
832
R/W DRIVE OR INTERFACE
836
NETWORK ADAPTER OR INTERFACE
800a,b
INTERNAL COMPONENTS
826
820
PROCESSOR(S)
822
RAM(S)
824
ROM(S)
828
TANGIBLE STORAGE DEVICE (S)
- OPERATING SYSTEM(S)
830

Fig. 6

RECOVERY OF TIME DUE TO AN UNPLANNED EVENT ON A RESERVED ROUTE

BACKGROUND

The present invention relates to route optimization, and more specifically to route optimization through recovery of time due to an unplanned event on a reserved route.

The use of global positioning system (GPS) navigation systems in automobiles is becoming commonplace. Users are increasingly dependent on GPS devices to plan and direct their routes, real-time. Currently, traffic is random, as people drive to and from locations in a completely unpredictable manner.

When a large number of drivers are traveling to the same destination, or in the same area, traffic jams occur with little coordinated planning to prevent them. Also, given the chaotic and currently unpredictable nature of society and driving, the quantity of cars driving from random destinations, taking random routes, and arriving at random locations makes optimizing the system very difficult. At best, some events have a degree of predictability, for example, when a popular event is planned (e.g., sporting event or concert), local authorities may dispatch officers to help direct traffic, or they may post signs warning of the traffic congestion, but this would only affect roads in the immediate vicinity of the event.

Some individuals may be willing to pay for specific routes or "reserve" a specific route versus other GPS device users. The reserved routes may be more direct than other reserved routes or non-reserved routes to a destination.

SUMMARY

According to one embodiment of the present invention a method of providing reserved routes for a plurality of vehicles. The method comprising the steps of: a computer monitoring at least a location communicated from each of a plurality of vehicles having GPS devices and traveling to destinations on reserved routes with guaranteed arrival times; the computer monitoring real-time traffic data associated with a plurality of reserved routes; the computer receiving a traffic event along at least one of the reserved routes; the computer determining if any of the plurality of vehicles are affected or will be affected by the traffic event and calculating alternate routes for those vehicles which are affected or will be affected by the traffic event; the computer sending the alternate routes to the GPS devices in the vehicles which are affected or will be affected by the traffic event, and repeating the method from the step of monitoring at least a location until a vehicle has reached the destination for which the vehicle received a guaranteed arrival time; and once the vehicle has reached the destination, the computer comparing an actual arrival time of the vehicle at the destination to the guaranteed arrival time, and if the actual arrival time is later than the guaranteed arrival time, crediting a user of the vehicle for at least a portion of an amount paid for reserving the reserved route.

According to another embodiment of the present invention, a computer program product for providing reserved routes for a plurality of vehicles comprising a computer comprising at least one processor, one or more memories, one or more computer readable storage media, the computer program product comprising a computer readable storage medium having program instructions embodied therewith. The program instructions executable by the computer to perform a method comprising: monitoring, by the computer, at least a location communicated from each of a plurality of vehicles having GPS devices and traveling to destinations on reserved routes with guaranteed arrival times; monitoring, by the computer, real-time traffic data associated with a plurality of reserved routes; receiving, by the computer, a traffic event along at least one of the reserved routes; determining, by the computer, if any of the plurality of vehicles are affected or will be affected by the traffic event and calculating alternate routes for those vehicles which are affected or will be affected by the traffic event; and sending, by the computer, the alternate routes to the GPS devices in the vehicles which are affected or will be affected by the traffic event, and repeating the program instructions from the step of monitoring at least a location until a vehicle has reached the destination for which the vehicle received a guaranteed arrival time; and once the vehicle has reached the destination, comparing, by the computer, an actual arrival time of the vehicle at the destination to the guaranteed arrival time, and if the actual arrival time is later than the guaranteed arrival time, crediting a user of the vehicle for at least a portion of an amount paid for reserving the reserved route.

According to another embodiment of the present invention, a system for providing reserved routes for a plurality of vehicles comprising a computer comprising at least one processor, one or more memories, one or more computer readable storage media having program instructions executable by the computer to perform the program instructions. The program instructions comprising: monitoring, by the computer, at least a location communicated from each of a plurality of vehicles having GPS devices and traveling to destinations on reserved routes with guaranteed arrival times; monitoring, by the computer, real-time traffic data associated with a plurality of reserved routes; receiving, by the computer, a traffic event along at least one of the reserved routes; determining, by the computer, if any of the plurality of vehicles are affected or will be affected by the traffic event and calculating alternate routes for those vehicles which are affected or will be affected by the traffic event; and sending, by the computer, the alternate routes to the GPS devices in the vehicles which are affected or will be affected by the traffic event, and repeating the program instructions from the step of monitoring at least a location until a vehicle has reached the destination for which the vehicle received a guaranteed arrival time; and once the vehicle has reached the destination, comparing, by the computer, an actual arrival time of the vehicle at the destination to the guaranteed arrival time, and if the actual arrival time is later than the guaranteed arrival time, crediting a user of the vehicle for at least a portion of an amount paid for reserving the reserved route.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** depicts an exemplary diagram of a possible data processing environment in which illustrative embodiments may be implemented.

FIG. **2** shows a flow diagram of a method of reserving routes with arrival time guarantees.

FIG. **3** shows a flow diagram of a method of monitoring vehicle progress along the reserved routes and aiding in the guaranteeing the arrival time of the vehicle to the destination within a specific amount of time.

FIG. **4** shows a schematic of vehicles interacting with a navigation reservation system.

FIG. **5** shows a schematic of a navigation reservation system.

FIG. **6** illustrates internal and external components of a client or device computer and a server computer in which illustrative embodiments may be implemented.

DETAILED DESCRIPTION

In an illustrated embodiment, it is recognized that guaranteeing an arrival time of a vehicle to a location may be achieved with dynamic route replanning to compensate for an unplanned event, such as a traffic event. The dynamic route replanning may include, but is not limited to waiving, refunding or reduction of fees on toll roads (if rerouted to a toll road), permission to drive in an express lane, carpool lane or other lane with restrictions that the vehicle would otherwise not meet, exceed the posted speed limit (with permission from the authorities), or recommending an alternate mode of transportation altogether.

In an illustrated embodiment, a reserved route is a route in which a vehicle may travel to a destination that is limited to a specific number of vehicles or type of vehicles.

In another illustrated embodiment, reserved routes to a destination may include an arrival time guarantee. If the arrival time is outside of the guaranteed arrival time, the user may be refunded or credited a percentage of the cost associated with purchasing the reserved route with the arrival time guarantee. The reserved routes with arrival time guarantees may be divided into tiers or levels, with different tiers having different costs and arrival time guarantees.

In another illustrated embodiment, it is recognized that an "unplanned event", for example a traffic event, is an occurrence that happens at a given place and time involving a vehicle, road network, or traffic device that may impede the time in which it will take a vehicle to travel from a first location to a second location, with the occurrence being present between the first location and the second location. A "reroute" is an alternative path for the vehicle to travel from the first location to the second location which avoids or circumvents the traffic event.

FIG. **1** is an exemplary diagram of a possible data processing environment provided in which illustrative embodiments may be implemented. It should be appreciated that FIG. **1** is only exemplary and is not intended to assert or imply any limitation with regard to the environments in which different embodiments may be implemented. Many modifications to the depicted environments may be made.

Referring to FIG. **1**, network data processing system **51** is a network of computers in which illustrative embodiments may be implemented. Network data processing system **51** contains network **50**, which is the medium used to provide communication links between various devices and computers connected together within network data processing system **51**. Network **50** may include connections, such as wire, wireless communication links, or fiber optic cables.

In the depicted example, device computer **52**, a repository **53**, and a server computer **54** connect to network **50**. Also connected to a network may be a feed of real-time traffic information and monitoring services. In other exemplary embodiments, network data processing system **51** may include additional client or device computers, storage devices or repositories, server computers, and other devices not shown.

Device computer **52** includes a set of internal components **800***a* and a set of external components **900***a*, further illustrated in FIG. **6**. Device computer **52** may be, for example, a mobile device, a cell phone, a personal digital assistant, a netbook, a laptop computer, a tablet computer, a desktop computer, a global position system (GPS) device or any other type of computing device.

Device computer **52** may contain an interface **55**. The interface **55** may accept commands and data entry from a user. The interface **55** can be, for example, a command line interface, a graphical user interface (GUI), or a web user interface (WUI) through which a user can input a payment method (which is processed by the server computer **54** through the payment program **68**) or a location in which they wish to travel to and/or a reserved route, or alternatively on server computer **54**. The device computer **52** preferably includes a GPS program **66**. While not shown, it may be desirable to have the GPS program be present on the server computer **54**.

Server computer **54** includes a set of internal components **800***b* and a set of external components **900***b* illustrated in FIG. **6**. The server computer **54** may contain an interface **65**. The interface **65** may accept commands and data entry. The interface **65** can be, for example, a command line interface, a graphical user interface (GUI), or a web user interface (WUI) which can accept and process payments from a user, for example through a payment program **68**. The server computer **54** also preferably includes a monitoring and reroute program **67**.

In the depicted example, server computer **54** provides information, such as boot files, operating system images, and applications to device computer **52**. Server computer **54** can compute the information locally or extract the information from other computers on network **50**.

Program code and programs such as a monitoring and reroute program **67**, payment program **68**, and/or a GPS program **66** may be stored on at least one of one or more computer-readable tangible storage devices **830** shown in FIG. **6**, on at least one of one or more portable computer-readable tangible storage devices **936** as shown in FIG. **6**, on repository **53** connected to network **50**, or downloaded to a data processing system or other device for use. For example, program code and programs such as a monitoring and reroute program **67**, payment program **68**, and/or a GPS program **66** may be stored on at least one of one or more tangible storage devices **830** on server computer **54** and downloaded to the device computer **52**. Alternatively, server computer **54** can be a web server, and the program code and programs such as a monitoring and reroute program **67**, payment program **68**, and/or GPS program **66** may be stored on at least one of the one or more tangible storage devices **830** on server computer **54** and accessed on the device computer **52**. Monitoring and reroute program **67**, payment program **68**, and/or GPS program **66** can be accessed on device computer **52** through interface **55**. In other exemplary embodiments, the program code and programs such as a monitoring and reroute program **67**, payment program **68**, and/or GPS program **66** may be stored on at least one of one or more computer-readable tangible storage devices **830** on server computer **54** or distributed between two or more servers.

FIG. **4** shows a schematic of vehicles interacting with a navigation reservation system. A navigation reservation system **102** receives "real-time" traffic information. The navigation reservation system **102** bi-directionally communicates with vehicles **110***a*-**110***n* with GPS devices **106***a*-**106***n*.

In one embodiment, reserved routes are presented to the user in tiers for purchase. A first tier may, for example, provide a route for reservation that guarantees that the vehicle will arrive within N % of the time allocated for the trip. A second tier may, for example, provide a reserved route or route for reservation (either the same as the first tier or dif-

ferent) that guarantees that the vehicle will arrive within N+10% of the time allocated for the trip. A third tier may for example provide a reserved route (either the same as the first and second tier or different) that guarantees that the vehicle will arrive within N+20% of the time allocated for the trip. Additional tiers may be present and the time percentages varying. The arrival time with the smallest percentage of the time allocated for the arrival time guarantee would be the most expensive route to reserve. As the percentage of time allocated for the arrival time increases, the cost to the user to reserve the route may decrease. N may be any number greater than zero.

The navigation reservation system **102**, shown in greater detail in FIG. **5**, may include a public works repository **120**, a route requests repository **122**, a reserved route offers repository **124**, a payment program **68**, and a reroute and monitoring program **67**.

The public works repository **120** may include information on availability of special permissions from transportation departments, for example to drive on specific roads, in specific lanes or at speeds greater than a posted speed limit, or arrangements to drive at reduced prices on toll roads. The route requests repository **122** includes requests for reserved routes, including routes that have been requested, but not paid for.

The offers repository **124** includes reserved routes that have been paid for by users. The reroute and monitoring program **67** is in communication with the public works repository **122**, the route requests repository **122**, the offers repository **124**, and the payment program **68**.

The payment program **68** is in communication with the offers repository **124**, the reroute and monitoring program **67**, and the route requests repository **122** and processes payments for the reserved routes with arrival time guarantees.

In FIG. **4**, for example purposes only, one of the vehicles **110***a* with GPS device **106***a* has reserved a route in the first tier, with an arrival guarantee time that the vehicle will arrive within 2% of the time allocated for the trip and has paid $25. Vehicle **110***b* with GPS device **106***b* reserved a route in the second tier, with an arrival guarantee time that the vehicle will arrive within 12% of the time allocated for the trip and has paid $20. Vehicle **110***b* with GPS device **106***b* reserved a route in the third tier, with an arrival guarantee time that the vehicle will arrive within 22% of the time allocated for the trip and has paid $15.

The navigation reservation system **102** monitors the vehicles **110***a*-**110***c* on their respective reserved routes and alters the reserved route to optimize the arrival time based on the paid reserved route so as to meet the guaranteed time. If the arrival time is not within the arrival time guaranteed, the navigation reservation system **102** may credit a portion of the amount paid for the reserved route back to the user.

FIG. **2** shows a flow diagram of a method of reserving routes and arrival time guarantees with the navigation reservation system.

In a first step, the navigation reservation system **102** receives a request from a GPS device of vehicle, for example through a GPS program **66**, to reserve a route for the vehicle to travel to a destination (step **202**), for example through the reroute and monitoring program **67**.

The reroute and monitoring program **67** determines a route to the destination requested, current position of the vehicle requesting the route, and time from the current position to the destination based on a plurality of established routes (step **204**).

The reroute and monitoring program **67** correlates the arrival time to the destination through the plurality of routes and associates a cost for reserving a route with an arrival time and guarantee of arriving within a specific time frame (step **206**).

The reroute and monitoring program **67** sends route options to a GPS device for display to a user with arrival time guarantees and associated costs (step **208**).

If a payment is not received (step **210**), the method ends.

If a payment is received (step **210**), the route is reserved and the route details are sent with the guaranteed arrival time to the GPS device for monitoring during route execution (step **212**).

Referring to FIG. **3**, which shows a flow diagram of a method of monitoring vehicle progress along the reserved routes and aiding in the guaranteeing the arrival time of the vehicle to the destination within a specific amount of time.

The location, from the GPS device within the vehicle, speed, traffic report, for example through real time traffic information, and emergency reports along purchased routes or reserved routes with arrival time guarantees are monitored (step **214**), for example through the reroute and monitoring program **67**.

The reroute and monitoring program **67** receives a traffic event or an unplanned event along a purchased or reserved route (step **216**).

The reroute and monitoring program **67** determines or evaluates what vehicles affected or to be affected by the unplanned event (step **218**) and calculates alternative routes for users that to aid in having the users arrive within the specific time frame of the guaranteed arrival time (step **220**).

It should be noted that the reroute and monitoring program **67** considers all the cars currently on the road or will be on the road within a specific amount of time to determine the most direct route for the users with reserved or purchased routes. The reroute and monitoring program **67** preferably gives priority to the users or vehicles that paid the most money and have the smaller window (lower percentage of time) in which the user can actually get to the destination and still meet the arrival time guarantee.

The reroute and monitoring program **67** sends alternate routes or reroutes to certain vehicles, for example including driving condition allowances, depending on the route purchased or reserved and continues to monitor the at least a location of the vehicle until the vehicle reaches its destination. For example, when the reserved or purchased routes are in tiers or service levels, a vehicle may be allowed to travel on a toll road at reduced fees or waved fees, receive permission to drive in an express lane, carpool lane or other lane with restrictions that the vehicle would otherwise not meet, or exceed the posted speed limit (with permission from the authorities). If the navigation reservation system **102** reroutes one of the vehicles, say car **110***b*, from a free route chosen by the user onto a toll route in order to meet the guarantee, the reservation system may reduce or rebate part of the guarantee fee to compensate for the toll charged by the road.

Alternatively, the user may be recommended to use an alternate mode of transportation altogether, such as bus, rail, or taxi.

The GPS device accepts the alternate route or reroute and/or driving condition allowances and proceeds on alternate route or with driving condition allowances to the destination (step **224**).

Once the vehicle arrives at a destination, the payment program **68** compares the actual arrival time to the guaranteed arrival time (step **226**), and if the arrival time is met (step **228**), the method ends.

If the actual arrival time is not within the guaranteed arrival time (step **228**), a refund or credit is used to the user for at least

a portion of the amount paid for the reserved route and guaranteed arrival time (step **230**) and the method ends.

FIG. **6** illustrates internal and external components of device computer **52** and server computer **54** in which illustrative embodiments may be implemented. In FIG. **6**, device computer **52** and server computer **54** include respective sets of internal components **800***a*, **800***b* and external components **900***a*, **900***b*. Each of the sets of internal components **800***a*, **800***b* includes one or more processors **820**, one or more computer-readable RAMs **822** and one or more computer-readable ROMs **824** on one or more buses **826**, and one or more operating systems **828** and one or more computer-readable tangible storage devices **830**. The one or more operating systems **828**, monitoring and reroute program **67**, payment program **68**, and GPS program **66** are stored on one or more of the computer-readable tangible storage devices **830** for execution by one or more of the processors **820** via one or more of the RAMs **822** (which typically include cache memory). In the embodiment illustrated in FIG. **6**, each of the computer-readable tangible storage devices **830** is a magnetic disk storage device of an internal hard drive. Alternatively, each of the computer-readable tangible storage devices **830** is a semiconductor storage device such as ROM **824**, EPROM, flash memory or any other computer-readable tangible storage device that can store a computer program and digital information.

Each set of internal components **800***a*, **800***b* also includes a R/W drive or interface **832** to read from and write to one or more portable computer-readable tangible storage devices **936** such as a CD-ROM, DVD, memory stick, magnetic tape, magnetic disk, optical disk or semiconductor storage device. Monitoring and reroute program **67**, payment program **68**, and GPS program **66** can be stored on one or more of the portable computer-readable tangible storage devices **936**, read via R/W drive or interface **832** and loaded into hard drive **830**.

Each set of internal components **800***a*, **800***b* also includes a network adapter or interface **836** such as a TCP/IP adapter card. Monitoring and reroute program **67**, payment program **68**, and GPS program **66** can be downloaded to the device computer **52** and server computer **54** from an external computer via a network (for example, the Internet, a local area network or other, wide area network) and network adapter or interface **836**. From the network adapter or interface **836**, monitoring and reroute program **67**, payment program **68**, and GPS program **66** are loaded into hard drive **830**. The network may comprise copper wires, optical fibers, wireless transmission, routers, firewalls, switches, gateway computers and/or edge servers.

Each of the sets of external components **900***a*, **900***b* includes a computer display monitor **920**, a keyboard **930**, and a computer mouse **934**. Each of the sets of internal components **800***a*, **800***b* also includes device drivers **840** to interface to computer display monitor **920**, keyboard **930** and computer mouse **934**. The device drivers **840**, R/W drive or interface **832** and network adapter or interface **836** comprise hardware and software (stored in storage device **830** and/or ROM **824**).

Monitoring and reroute program **67**, payment program **68**, and GPS program **66** can be written in various programming languages including low-level, high-level, object-oriented or non object-oriented languages. Alternatively, the functions of a monitoring and reroute program **67**, payment program **68**, and GPS program **66** can be implemented in whole or in part by computer circuits and other hardware (not shown).

The present invention may be a system, a method, and/or a computer program product. The computer program product may include a computer readable storage medium (or media) having computer readable program instructions thereon for causing a processor to carry out aspects of the present invention.

The computer readable storage medium can be a tangible device that can retain and store instructions for use by an instruction execution device. The computer readable storage medium may be, for example, but is not limited to, an electronic storage device, a magnetic storage device, an optical storage device, an electromagnetic storage device, a semiconductor storage device, or any suitable combination of the foregoing. A non-exhaustive list of more specific examples of the computer readable storage medium includes the following: a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), a static random access memory (SRAM), a portable compact disc read-only memory (CD-ROM), a digital versatile disk (DVD), a memory stick, a floppy disk, a mechanically encoded device such as punch-cards or raised structures in a groove having instructions recorded thereon, and any suitable combination of the foregoing. A computer readable storage medium, as used herein, is not to be construed as being transitory signals per se, such as radio waves or other freely propagating electromagnetic waves, electromagnetic waves propagating through a waveguide or other transmission media (e.g., light pulses passing through a fiber-optic cable), or electrical signals transmitted through a wire.

Computer readable program instructions described herein can be downloaded to respective computing/processing devices from a computer readable storage medium or to an external computer or external storage device via a network, for example, the Internet, a local area network, a wide area network and/or a wireless network. The network may comprise copper transmission cables, optical transmission fibers, wireless transmission, routers, firewalls, switches, gateway computers and/or edge servers. A network adapter card or network interface in each computing/processing device receives computer readable program instructions from the network and forwards the computer readable program instructions for storage in a computer readable storage medium within the respective computing/processing device.

Computer readable program instructions for carrying out operations of the present invention may be assembler instructions, instruction-set-architecture (ISA) instructions, machine instructions, machine dependent instructions, microcode, firmware instructions, state-setting data, or either source code or object code written in any combination of one or more programming languages, including an object oriented programming language such as Java, Smalltalk, C++ or the like, and conventional procedural programming languages, such as the "C" programming language or similar programming languages. The computer readable program instructions may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user's computer through any type of network, including a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider). In some embodiments, electronic circuitry including, for example, programmable logic circuitry, field-programmable gate arrays (FPGA), or programmable logic arrays (PLA) may execute the computer readable program instructions by utilizing state information of the computer readable

program instructions to personalize the electronic circuitry, in order to perform aspects of the present invention.

Aspects of the present invention are described herein with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems), and computer program products according to embodiments of the invention. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer readable program instructions.

These computer readable program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks. These computer readable program instructions may also be stored in a computer readable storage medium that can direct a computer, a programmable data processing apparatus, and/or other devices to function in a particular manner, such that the computer readable storage medium having instructions stored therein comprises an article of manufacture including instructions which implement aspects of the function/act specified in the flowchart and/or block diagram block or blocks.

The computer readable program instructions may also be loaded onto a computer, other programmable data processing apparatus, or other device to cause a series of operational steps to be performed on the computer, other programmable apparatus or other device to produce a computer implemented process, such that the instructions which execute on the computer, other programmable apparatus, or other device implement the functions/acts specified in the flowchart and/or block diagram block or blocks.

The flowchart and block diagrams in the Figures illustrate the architecture, functionality, and operation of possible implementations of systems, methods, and computer program products according to various embodiments of the present invention. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of instructions, which comprises one or more executable instructions for implementing the specified logical function(s). In some alternative implementations, the functions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustration, and combinations of blocks in the block diagrams and/or flowchart illustration, can be implemented by special purpose hardware-based systems that perform the specified functions or acts or carry out combinations of special purpose hardware and computer instructions.

Having thus described the invention of the present application in detail and by reference to embodiments thereof, it will be apparent that modifications and variations are possible without departing from the scope of the invention defined in the appended claims.

What is claimed is:

1. A method of providing reserved routes for a plurality of vehicles, comprising the steps of:

a computer monitoring at least a location communicated from each of a plurality of vehicles having GPS devices and traveling to destinations on reserved routes with guaranteed arrival times;

the computer monitoring real-time traffic data associated with a plurality of reserved routes;

the computer receiving a traffic event along at least one of the reserved routes;

the computer determining if any of the plurality of vehicles are affected or will be affected by the traffic event and calculating alternate routes for those vehicles which are affected or will be affected by the traffic event; and

the computer sending the alternate routes to the GPS devices in the vehicles which are affected or will be affected by the traffic event, and repeating the method from the step of monitoring at least a location until a vehicle has reached the destination for which the vehicle received a guaranteed arrival time; and once the vehicle has reached the destination, the computer comparing an actual arrival time of the vehicle at the destination to the guaranteed arrival time, and if the actual arrival time is later than the guaranteed arrival time, crediting a user of the vehicle for at least a portion of an amount paid for reserving the reserved route.

2. The method of claim **1**, wherein the computer additionally sends driving condition allowances to the GPS devices in the step of sending the alternate routes.

3. The method of claim **1**, wherein prior to the step of the computer monitoring at least a location of a vehicle, the method comprises the steps of:

the computer receiving a request from the GPS device of the vehicle to reserve a route for the vehicle to travel to a destination;

the computer determining at least one route to the destination from the current position of the vehicle;

the computer calculating an arrival time at the destination along the at least one route to the destination;

the computer associating a cost for reserving the route with at least one arrival time guarantee;

the computer sending the at least one route with the at least one arrival time guarantee and the cost associated with the at least one arrival time guarantee to the GPS device; and

the computer receiving from the GPS device a choice of at least one reserved route with an arrival time guarantee.

4. The method of claim **3**, wherein in the step of associating a cost, the computer associates a plurality of costs to a plurality of arrival time guarantees for the route, such that the computer sends a plurality of arrival time guarantees at differing costs to the GPS device for the user to select.

5. The method of claim **2**, wherein the driving condition allowances include waiving toll road fees.

6. The method of claim **2**, wherein the driving condition allowances include permission to drive in a lane or on a road that has restrictions that the vehicle would otherwise not meet.

7. The method of claim **2**, wherein the driving condition allowances include exceeding posted speed limits for at least a portion of the alternate route.

8. A computer program product for providing reserved routes for a plurality of vehicles comprising a computer comprising at least one processor, one or more memories, one or more computer readable storage media, the computer program product comprising a computer readable non-transitory storage medium having program instructions embodied therewith, the program instructions executable by the computer to perform a method comprising:

monitoring, by the computer, at least a location communicated from each of a plurality of vehicles having GPS devices and traveling to destinations on reserved routes with guaranteed arrival times;

monitoring, by the computer, real-time traffic data associated with a plurality of reserved routes;

receiving, by the computer, a traffic event along at least one of the reserved routes;

determining, by the computer, if any of the plurality of vehicles are affected or will be affected by the traffic event and calculating alternate routes for those vehicles which are affected or will be affected by the traffic event; and

sending, by the computer, the alternate routes to the GPS devices in the vehicles which are affected or will be affected by the traffic event, and repeating the program instructions from the step of monitoring at least a location until a vehicle has reached the destination for which the vehicle received a guaranteed arrival time; and once the vehicle has reached the destination, comparing, by the computer, an actual arrival time of the vehicle at the destination to the guaranteed arrival time, and if the actual arrival time is later than the guaranteed arrival time, crediting a user of the vehicle for at least a portion of an amount paid for reserving the reserved route.

9. The computer program product of claim **8**, wherein the computer additionally sends driving condition allowances to the GPS devices in the step of sending the alternate routes.

10. The computer program product of claim **8**, wherein prior to monitoring at least a location of a vehicle, by the computer comprising:

receiving, by the computer, a request from the GPS device of the vehicle to reserve a route for the vehicle to travel to a destination;

determining, by the computer, at least one route to the destination from the current position of the vehicle;

calculating, by the computer, an arrival time at the destination along the at least one route to the destination;

associating, by the computer, a cost for reserving the route with at least one arrival time guarantee;

sending, by the computer, the at least one route with the at least one arrival time guarantee and the cost associated with the at least one arrival time guarantee to the GPS device; and

receiving, by the computer, from the GPS device a choice of at least one reserved route with an arrival time guarantee.

11. The computer program product of claim **10**, wherein associating, by the computer, a cost, associates a plurality of costs to a plurality of arrival time guarantees for the route, such that the computer sends a plurality of arrival time guarantees at differing costs to the GPS device for the user to select.

12. The computer program product of claim **9**, wherein the driving condition allowances include waiving toll road fees.

13. The computer program product of claim **9**, wherein the driving condition allowances include permission to drive in a lane or on a road that has restrictions that the vehicle would otherwise not meet.

14. The computer program product of claim **9**, wherein the driving condition allowances include exceeding posted speed limits for at least a portion of the alternate route.

15. A computer system for providing reserved routes for a plurality of vehicles comprising a computer comprising at least one processor, one or more memories, one or more computer readable storage media having program instructions executable by the computer to perform the program instructions comprising:

monitoring, by the computer, at least a location communicated from each of a plurality of vehicles having GPS devices and traveling to destinations on reserved routes with guaranteed arrival times;

monitoring, by the computer, real-time traffic data associated with a plurality of reserved routes;

receiving, by the computer, a traffic event along at least one of the reserved routes;

determining, by the computer, if any of the plurality of vehicles are affected or will be affected by the traffic event and calculating alternate routes for those vehicles which are affected or will be affected by the traffic event; and

sending, by the computer, the alternate routes to the GPS devices in the vehicles which are affected or will be affected by the traffic event, and repeating the program instructions from the step of monitoring at least a location until a vehicle has reached the destination for which the vehicle received a guaranteed arrival time; and once the vehicle has reached the destination, comparing, by the computer, an actual arrival time of the vehicle at the destination to the guaranteed arrival time, and if the actual arrival time is later than the guaranteed arrival time, crediting a user of the vehicle for at least a portion of an amount paid for reserving the reserved route.

16. The system of claim **15**, wherein the computer additionally sends driving condition allowances to the GPS devices in the program instructions of sending the alternate routes.

17. The system of claim **15**, wherein prior to the program instructions of monitoring at least a location of a vehicle, by the computer, the program instructions comprises:

receiving, by the computer, a request from the GPS device of the vehicle to reserve a route for the vehicle to travel to a destination;

determining, by the computer, at least one route to the destination from the current position of the vehicle;

calculating, by the computer, an arrival time at the destination along the at least one route to the destination;

associating, by the computer, a cost for reserving the route with at least one arrival time guarantee;

sending, by the computer, the at least one route with the at least one arrival time guarantee and the cost associated with the at least one arrival time guarantee to the GPS device; and

receiving, by the computer, from the GPS device a choice of at least one reserved route with an arrival time guarantee.

18. The system of claim **17**, wherein associating, by the computer, a cost, associates a plurality of costs to a plurality of arrival time guarantees for the route, such that the computer sends a plurality of arrival time guarantees at differing costs to the GPS device for the user to select.

19. The system of claim **16**, wherein the driving condition allowances include waiving toll road fees.

20. The system of claim **16**, wherein the driving condition allowances include permission to drive in a lane or on a road that has restrictions that the vehicle would otherwise not meet.

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